

## In The Clinic: Understanding Knee Pain

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## Disclosures

- ▶ **Disclosure of Relevant Financial Relationships**
  - ▶ I have no financial relationships to disclose.
- ▶ **Disclosure of Off-Label and/or Investigative Uses**
  - ▶ I will not discuss off label use and/or investigational use in my presentation.

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## Objectives

1. **Understand the Basic Anatomy of the Knee:**
  - Review key structures, including bones, ligaments, cartilage, and muscles.
2. **Discuss Epidemiology and Risk Factors:**
  - Examine the prevalence of knee pain across different age groups and genders, with an emphasis on common risk factors.
3. **Differentiate Between Acute and Chronic Knee Pain Etiologies:**
  - Identify causes of acute vs. chronic knee pain, including trauma, degenerative conditions, and inflammatory processes.
4. **Learn Physical Exam Techniques and Diagnostic Maneuvers:**
  - Gain proficiency in exam findings and specific maneuvers to assess knee stability, meniscal integrity, and patellofemoral function.
5. **Review Diagnostic Work-Up Protocols:**
  - Understand indications for imaging and laboratory testing to diagnose common knee conditions effectively.
6. **Explore Evidence-Based Treatment Options:**
  - Outline conservative, pharmacological, and surgical treatment options, including when to refer patients for specialized care.
7. **Focus on Specific Conditions:**
  - Deepen understanding of knee osteoarthritis, meniscus tears, and patellofemoral joint pain, with emphasis on management in primary care settings.

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## Knee Pain in Musculoskeletal Health

- ▶ **Prevalence:**
  - Affects 25% of adults at some point, with prevalence increasing with age.
  - Most frequent reason for orthopedic referrals.
- ▶ **Impact on Daily Life:**
  - Leads to reduced mobility, affecting work, leisure, and daily activities.
  - Contributes significantly to disability in older adults.
- ▶ **Economic Burden:**
  - Costs associated with treatment, loss of productivity, and surgeries exceed billions of dollars annually worldwide.
  - Rising due to an aging population and increasing rates of obesity.
- ▶ **Association with Systemic Conditions:**
  - Often linked to systemic diseases like rheumatoid arthritis, gout, and metabolic syndrome.
- ▶ **Common Underlying Causes:**
  - Acute Injuries: Sports-related ligament or meniscal tears.
  - Chronic Conditions: Osteoarthritis, patellofemoral pain syndrome, and tendinopathies.
- ▶ **Relevance to Primary Care:**
  - Early detection and management can prevent progression to chronic disability.
  - Emphasis on lifestyle modification, patient education, and multidisciplinary care.

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## Overview of the Knee Joint

- **Basic Anatomy:**
  - **Bones:**
    - **Femur (thigh bone):** Forms the upper part of the knee joint.
    - **Tibia (shin bone):** Supports the lower portion of the knee.
    - **Patella (kneecap):** Protects the front of the knee joint.
  - **Cartilage:**
    - **Menisci:** C-shaped cartilage that cushions and stabilizes the joint.
    - **Articular Cartilage:** Covers the ends of bones to allow smooth movement.
  - **Ligaments:**
    - **ACL (Anterior Cruciate Ligament):** Prevents forward movement of the tibia.
    - **PCL (Posterior Cruciate Ligament):** Prevents backward movement of the tibia.
    - **MCL (Medial Collateral Ligament) and LCL (Lateral Collateral Ligament):** Stabilize the sides of the knee.
  - **Tendons:**
    - Quadriceps and patellar tendons connect muscles to bones.
- **Function:**
  - **Weight Bearing:** Supports the body's weight during standing and movement.
  - **Mobility:** Facilitates walking, running, and other complex movements.
  - **Stability:** Provides a balance between flexibility and strength to handle various physical activities.
  - **Shock Absorption:** The menisci and cartilage help absorb impact forces during activity.
- **Key Features:**
  - Largest and one of the most complex joints in the body.

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## Knee Anatomy-Bones

- **Femur:**
  - Largest and strongest bone in the body.
  - **Medial and Lateral Condyles:**
    - Rounded ends that articulate with the tibia and patella.
  - **Trochlear Groove:**
    - Smooth groove where the patella slides during knee movement.
- **Tibia (Shin Bone):**
  - Second-largest bone, bearing most of the body's weight.
  - **Tibial Plateau:**
    - Flattened top surface that articulates with the femoral condyles.
    - Divided into **medial** and **lateral** compartments.
  - **Tibial Tuberosity:**
    - Attachment site for the patellar tendon.
- **Patella (Kneecap):**
  - Largest sesamoid bone in the body.
  - Embedded within the quadriceps tendon.
  - **Functions:**
    - Protects the knee joint.
    - Increases leverage for the quadriceps muscle, enhancing knee extension.
- **Key Features:**
  - All bones are covered with **articular cartilage** to allow smooth, pain-free movement.



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## Knee Anatomy-Ligaments

**Overview:**

- The knee is stabilized by four primary ligaments:
  - Anterior Cruciate Ligament (ACL)
  - Posterior Cruciate Ligament (PCL)
  - Medial Collateral Ligament (MCL)
  - Lateral Collateral Ligament (LCL)

**Cruciate Ligaments (Inside the Knee Joint):**

- Anterior Cruciate Ligament (ACL):**
  - Function:**
    - Prevents the tibia from sliding forward on the femur.
    - Provides rotational stability to the knee.
  - Common Injury:** Often torn during sports involving cutting or pivoting.
- Posterior Cruciate Ligament (PCL):**
  - Function:**
    - Prevents the tibia from sliding backward on the femur.
    - Stabilizes the knee during sudden deceleration.
  - Common Injury:** Occurs in high-impact trauma (e.g., car accidents).

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## Knee Anatomy-Ligaments

- Collateral Ligaments (Outside the Knee Joint):**
- Medial Collateral Ligament (MCL):**
  - Function:**
    - Provides medial (inner) knee stability.
    - Resists valgus (inward) stress.
  - Common Injury:** Damaged by a blow to the outside of the knee.
- Lateral Collateral Ligament (LCL):**
  - Function:**
    - Provides lateral (outer) knee stability.
    - Resists varus (outward) stress.
  - Common Injury:** Less common; results from trauma to the inner knee.

**Key Roles of Ligaments:**

- Maintain knee stability during movement.
- Protect against excessive motion in specific directions.
- Provide proprioception to help the body sense joint position.

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## Knee Anatomy-Meniscus

- Meniscus:**
- Anatomy:**
  - Two C-shaped fibrocartilage structures:
    - Medial Meniscus: Larger and more fixed; prone to injury.
    - Lateral Meniscus: Smaller and more mobile.
- Function:**
  - Shock Absorption:** Distributes forces during weight-bearing activities.
  - Joint Stability:** Deepens the articular surface for better congruence between femur and tibia.
  - Load Distribution:** Reduces stress on the articular cartilage.
  - Proprioception:** Provides sensory feedback for joint position and movement.
- Injuries:**
  - Acute Tears:**
    - Common in young, active individuals during twisting or pivoting activities.
    - Symptoms: Pain, swelling, locking, or catching sensation.
  - Degenerative Tears:**
    - Seen in older adults due to wear and tear.
    - Symptoms: Intermittent pain, stiffness, mild swelling.

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## Knee Anatomy-Articular Cartilage

- Articular Cartilage:**
- Anatomy:**
  - Smooth, white tissue covering the ends of the femur, tibia, and back of the patella.
- Function:**
  - Reduces Friction:** Enables smooth movement of joint surfaces.
  - Load Distribution:** Protects bones by absorbing compressive forces.
  - Joint Longevity:** Maintains knee function over time.
- Injuries:**
  - Cartilage Damage:**
    - Common in trauma, repetitive stress, or degenerative diseases like osteoarthritis.
    - Symptoms: Pain, swelling, stiffness, and grinding sensation.
  - Chondral Lesions:**
    - Focal defects in the cartilage, often associated with meniscal or ligament injuries.

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## Epidemiology of Knee Pain

- Prevalence:**
  - Knee pain affects approximately 25% of adults at some point in their lives.
  - Leading cause of chronic disability in older adults.
- Age Distribution:**
  - Young Adults (18-39 years):**
    - Acute injuries (e.g., ACL or meniscus tears) are most common.
    - Sports and high-impact activities are leading contributors.
  - Middle-Aged Adults (40-59 years):**
    - Early signs of degenerative changes (e.g., mild osteoarthritis).
    - Continued trauma and wear-and-tear injuries.
  - Older Adults (60+ years):**
    - Up to 40% prevalence of symptomatic knee osteoarthritis.
    - Most cases linked to age-related cartilage degeneration.
- Gender Distribution:**
  - Women:**
    - Higher prevalence of knee pain, especially post-menopause.
    - More prone to degenerative conditions like osteoarthritis.
    - Hormonal and biomechanical factors contribute.
  - Men:**
    - Higher risks of acute injuries (e.g., ACL tears) in younger years.
    - Slightly lower prevalence of degenerative knee pain compared to women.
- Injury Statistics:**
  - ACL Tears:**
    - 100,000-200,000 ACL reconstructions performed annually in the U.S.
    - Women have a 2-4 times higher risk of ACL injuries than men in sports.
  - Osteoarthritis:**
    - Affects approximately 34 million adults in the U.S., with prevalence increasing with age.
  - Meniscal Tears:**
    - Common in both acute (young) and degenerative (older) populations.

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## Factors Contributing to Knee Pain

- 1. Demographic Factors:**
  - Age:**
    - Increased prevalence with age due to degenerative changes.
    - Common in older adults (60+ years): 40% with symptomatic knee osteoarthritis.
  - Gender:**
    - Women:**
      - Higher risk of osteoarthritis, particularly post-menopause.
      - Hormonal changes and wider joints affecting biomechanics.
    - Men:**
      - Higher rates of sports-related injuries in younger populations.
- 2. Lifestyle Factors:**
  - Obesity:**
    - A key risk factor for knee osteoarthritis.
    - Each additional pound of weight adds 4 pounds of pressure to the knee.
  - Physical Activity:**
    - High-impact sports: Increased risk of ACL and meniscus injuries.
    - Sedentary lifestyle: Weakens knee-supporting muscles, increasing joint stress.
  - Occupational Stress:**
    - Repetitive kneeling, squatting, or heavy lifting increases joint wear-and-tear.
- 3. Medical and Biomechanical Factors:**
  - Prior Injuries:**
    - History of ACL tears, meniscal injuries, or fractures raises the risk of chronic knee pain.
    - Joint Alignment Issues:
      - Genus valgum (knock knees) or genu varum (bow legs) cause uneven pressure on the knee joint.
    - Weakness in Supporting Muscles:**
      - Weak quadriceps or imbalanced muscles lead to instability and strain.
    - Systemic Conditions:**
      - Rheumatoid arthritis, gout, or metabolic syndromes increase inflammation and joint damage.
    - Footwear:**
      - High heels or poorly cushioned shoes contribute to misalignment and strain.
    - Surface:**
      - Hard or uneven surfaces increase the risk of acute injuries during physical activities.

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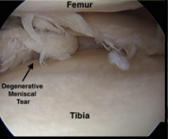
### Etiology of knee pain

- 1. Traumatic Injuries:**
  - Ligament Tears:**
    - Anterior Cruciate Ligament (ACL):**
      - Occurs during sudden deceleration, pivoting, or awkward landing.
      - Common in sports like soccer, basketball, and skiing.
      - Symptoms: Swelling, locking, giving way, and rapid swelling.
    - Medial Collateral Ligament (MCL):**
      - Result of a blow to the outer knee, causing valgus stress.
      - Overuse from long the inner knee and arthritis with side-to-side movements.
  - Meniscus Tears:**
    - Caused by twisting motions while the knee is flexed.
    - Symptoms: Locking, clicking, and localized joint line tenderness.
  - 2. Fractures:**
    - Patella Fracture:**
      - Commonly caused by direct trauma (e.g., a fall onto the knee).
      - Symptoms: Swelling, inability to straighten the knee, and localized joint pain.
    - Tibial Plateau Fracture:**
      - High-energy trauma (e.g., car accidents) or falls in older individuals with osteoporosis.
      - Symptoms: Pain, swelling, and difficulty bearing weight.
  - 3. Dislocations:**
    - Patellar Dislocation:**
      - Occurs when the kneecap slips out of the trochlear groove, often laterally.
      - Common in younger athletes with weak quadriceps or misalignment.
      - Symptoms: Visible deformity, pain, and swelling.
    - Knee Dislocation:**
      - A rare but serious injury involving displacement of the tibia relative to the femur.
      - High risk of vascular and nerve injury (medical emergency).
  - 4. Acute Tendon Injuries:**
    - Quadriceps or Patellar Tendon Rupture:**
      - Caused by sudden, forceful contraction of the quadriceps (e.g., jumping or knee thrust).
      - Symptoms: Inability to extend the knee and a palpable gap above or below the kneecap.

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### Etiology of Knee Pain

- 1. Degenerative Conditions:**
  - Osteoarthritis (OA):**
    - Most common cause of chronic knee pain.
    - Gradual wear and tear of articular cartilage leading to joint stiffness and pain.
    - Symptoms: Pain worsens with activity, morning stiffness, and crepitus.
    - Risk Factors: Age, obesity, prior injuries, and genetics.
  - Meniscal Degeneration:**
    - Caused by chronic wear rather than trauma.
    - Common in older adults with or without mechanical symptoms.
    - Symptoms: Intermittent pain, mild swelling, and occasional locking.
- 2. Tendinopathies:**
  - Patellar Tendinopathy ("Jumper's Knee"):**
    - Chronic overuse injury of the patellar tendon, common in athletes.
    - Symptoms: Pain localized to the lower pole of the patella, worsens with jumping or squatting.
  - Quadriceps Tendinopathy:**
    - Overuse injury affecting the quadriceps tendon insertion.
    - Symptoms: Pain above the kneecap during activity.

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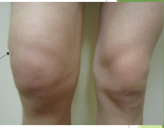

### Etiology of Knee Pain

- 1. Rheumatoid Arthritis (RA):**
  - Autoimmune condition causing chronic joint inflammation.
  - Symmetrical knee pain, swelling, and prolonged morning stiffness (>30 minutes).
  - Synovial membrane inflammation leads to joint damage.
  - May affect multiple joints beyond the knee.
- 2. Gout:**
  - Caused by deposition of uric acid crystals in the knee joint.
  - Sudden, severe pain, warmth, redness, and swelling.
  - Rule out septic arthritis.
  - Typically affects one joint during an acute flare.
  - High-purine diet, alcohol consumption, diuretic use.
- 3. Pseudogout (Calcium Pyrophosphate Deposition Disease - CPPD):**
  - Caused by deposition of calcium pyrophosphate crystals in the joint.
  - Pain, swelling, and stiffness similar to gout.
  - More common in older adults.
  - Often associated with chondrocalcinosis (calcium deposits visible on X-ray).
- 4. Septic Arthritis:**
  - Infection within the knee joint, typically bacterial.
  - Severe pain, fever, redness, and warmth.
  - Rapid onset with inability to bear weight and exquisitely painful arc of motion.
  - Orthopedic emergency requiring immediate intervention.
- 5. Other Inflammatory Causes:**
  - Reactive Arthritis:**
    - Inflammation triggered by an infection elsewhere in the body (e.g., gastrointestinal or urogenital infections).
    - Symptoms: Joint pain with accompanying systemic symptoms.
  - Lupus (Systemic Lupus Erythematosus - SLE):**
    - Autoimmune condition with intermittent joint pain and swelling.
  - Psoriatic Arthritis:**
    - Inflammatory arthritis associated with psoriasis.
    - Symptoms: Knee swelling, pain, and skin plaques.

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### Physical Exam and Diagnostic Maneuvers

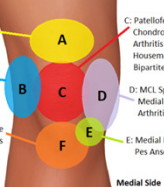
- 1. Inspection:**
  - Visual Assessment:**
    - Observe the patient standing and sitting.
  - Key Features to Assess:**
    - Swelling:**
      - Generalized (effusion) or localized (bursa or ligament injury).
    - Deformities:**
      - Genu valgum (knock knees) or genu varum (bow legs).
    - Skin Changes:**
      - Redness (inflammatory/infectious), scars, or bruising.
    - Atrophy:**
      - Thinning of quadriceps muscles, suggesting chronic injury or disuse.
    - Knee Alignment:**
      - Assess patellar tracking during flexion/extension.

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### Physical Exam and Diagnostic Maneuvers



- 1. Palpation:**
  - General Approach:**
    - Examine for tenderness, warmth, and swelling in a systematic manner.
  - Key Structures to Palpate:**
    - A:** Quadriceps Tendinitis, Quads Tendon Rupture
    - B:** ITB Syndrome, Lateral Meniscus Tear, LCL Injury, Dislocated Patella
    - C:** Patellofemoral Pain Syndrome, Chondromalacia Patella, Arthritis, Housemaids Knee, Bipartite Patella
    - D:** MCL Sprain, Medial Meniscus Tear, Arthritis
    - E:** Medial Plica Syndrome, Pes Anserine Bursitis
    - F:** Patellar Tendinitis, Osgood-Schlatters Disease, Osteochondritis Dissecans, SJ Disease, Infrapatellar Bursitis
- 2. Key Points During Examination:**
  - Compare with the unaffected knee for tactile reference.
  - Note crepitus, warmth, or soft-tissue irregularities.



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### Physical Exam and Diagnostic Maneuvers: Ligaments

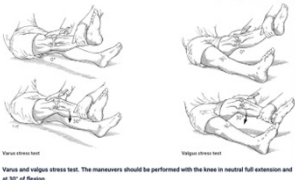
- 1. Anterior Cruciate Ligament (ACL):**
  - Lachman Test:**
    - Position: Patient supine, knee flexed 20-30 degrees.
    - Technique: Stabilize the femur and pull the tibia anteriorly.
    - Positive Sign: Increased anterior translation compared to the other knee.
  - Anterior Drawer Test:**
    - Position: Patient supine, knee flexed 90 degrees.
    - Technique: Pull the tibia anteriorly while stabilizing the foot.
    - Positive Sign: Excessive anterior movement.
- 2. Posterior Cruciate Ligament (PCL):**
  - Posterior Drawer Test:**
    - Position: Patient supine, knee flexed 90 degrees.
    - Technique: Push the tibia posteriorly while stabilizing the foot.
    - Positive Sign: Excessive posterior movement.
  - Sag Sign:**
    - Position: Patient supine, knees flexed 90 degrees.
    - Observation: Tibia sagging backward relative to the femur due to PCL insufficiency.

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### Physical Exam and Diagnostic Maneuvers: Ligaments

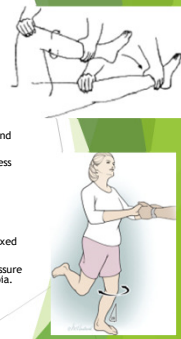
- ▶ **3. Medial Collateral Ligament (MCL):**
- ▶ **Valgus Stress Test:**
  - Position: Patient supine, knee flexed 20-30 degrees.
  - Technique: Apply a valgus force (push inward) to the knee.
  - Positive Sign: Pain or laxity along the medial aspect of the knee.
- ▶ **4. Lateral Collateral Ligament (LCL):**
- ▶ **Varus Stress Test:**
  - Position: Patient supine, knee flexed 20-30 degrees.
  - Technique: Apply a varus force (push outward) to the knee.
  - Positive Sign: Pain or laxity along the lateral aspect of the knee.
- ▶ **5. Additional Notes:**
  - Always compare with the unaffected knee.
  - Perform tests gently to avoid exacerbating pain or injury.



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### Physical Exam and Diagnostic Maneuvers: The Meniscus

- ▶ **1. McMurray Test:**
  - Position: Patient supine, knee fully flexed.
  - Technique:
    - Medial Meniscus: Rotate tibia externally while extending the knee.
    - Lateral Meniscus: Rotate tibia internally while extending the knee.
  - Positive Sign: Pain, clicking, or popping sensation along the joint line.
- ▶ **2. Thessaly Test:**
  - Position: Patient stands on one leg with the knee flexed at 20 degrees.
  - Technique: Patient rotates the body side-to-side while maintaining the knee flexion.
  - Positive Sign: Pain or locking sensation along the joint line.
- ▶ **3. Joint Line Tenderness:**
  - Technique: Palpate the medial and lateral joint lines.
  - Positive Sign: Localized tenderness over the meniscus.
    - POSITIVE IN KNEE OA AS WELL
- ▶ **4. Apley Compression Test:**
  - Position: Patient prone, knee flexed to 90 degrees.
  - Technique: Apply downward pressure to the heel while rotating the tibia.
  - Positive Sign: Pain during compression (indicates meniscal injury).



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### Physical Exam: The Patellofemoral Joint

- ▶ **1. Patellar Apprehension Test:**
  - Purpose: Assess patellar instability or dislocation risk.
  - Technique:
    - Position: Patient supine, knee flexed to 30 degrees.
    - Procedure: Apply lateral pressure to the patella.
  - Positive Sign: Patient shows apprehension or contracts the quadriceps to prevent dislocation.
- ▶ **2. Clarke's Test (Patellar Grind Test):**
  - Purpose: Evaluate patellofemoral pain or cartilage damage.
  - Technique:
    - Position: Patient supine, legs extended.
    - Procedure: Apply downward pressure on the superior patella while the patient contracts the quadriceps.
  - Positive Sign: Pain or grinding sensation during quadriceps contraction.
  - Abnormal Values: Suggest misalignment or patellofemoral dysfunction.
- ▶ **3. Palpation:**
  - Purpose: Identify tenderness or abnormalities.
  - Technique:
    - Palpate along the patellar borders and behind the patella.
    - Check for crepitus or localized pain, which may indicate chondromalacia or patellofemoral arthritis.



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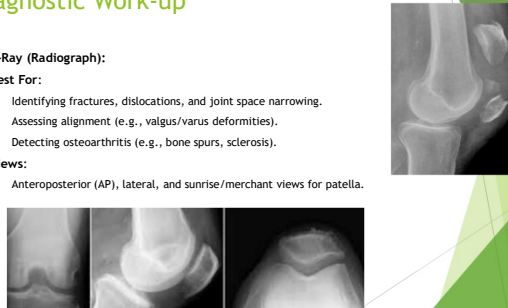
### Diagnostic Work-up

- ▶ **When to Use Imaging:**
- ▶ **Indications:**
  - Persistent pain unresponsive to conservative treatment.
  - Acute trauma with instability, deformity, or significant swelling.
  - Suspected fractures, dislocations, or ligamentous injuries.
  - Suspicion of systemic or infectious processes (e.g., septic arthritis, gout).
  - Chronic conditions with functional limitations (e.g., osteoarthritis).
- ▶ **Common Imaging Modalities**
  - X-Ray
  - MRI
  - CT
  - Ultrasound
  - Bone Scan.

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### Diagnostic Work-up

- ▶ **X-Ray (Radiograph):**
- ▶ **Best For:**
  - Identifying fractures, dislocations, and joint space narrowing.
  - Assessing alignment (e.g., valgus/varus deformities).
  - Detecting osteoarthritis (e.g., bone spurs, sclerosis).
- ▶ **Views:**
  - Anteroposterior (AP), lateral, and sunrise/merchant views for patella.



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### Diagnostic Work-Up

**Indications for Radiography in Patients with Acute Knee Injury**

Indication	ACR Criteria	Ottawa Knee Rule	Pittsburgh Knee Rule
Age < 12 or > 50 years			X
Age > 55 years		X	
Altered mental status	X		
Fall or blunt trauma			X
Inability to bear weight for four steps (unable to transfer weight twice) immediately after injury or in the emergency setting	X	X	X
Inability to flex knee to 90°	X	X	
Joint effusion within 24 hours of a direct blow or fall	X		
Tenderness over head of fibula or isolated to patella without other bony tenderness	X	X	

ACR = American College of Radiology

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### Diagnostic Work-up

- Magnetic Resonance Imaging (MRI):**
  - Best For:**
    - Soft tissue evaluation: ACL, PCL, menisci, cartilage, tendons.
    - Detecting bone edema or occult fractures.
  - Indications:**
    - Suspected ligament or meniscal tears.
    - Persistent pain with unclear etiology after X-rays.
- Ultrasound:**
  - Best For:**
    - Assessing superficial soft tissue (e.g., tendons, bursae).
    - Guiding joint aspiration or injection.
  - Indications:**
    - Suspected bursitis or tendinitis.
- Computed Tomography (CT):**
  - Best For:**
    - Complex fractures and preoperative planning.
  - Indications:**
    - Suspected tibial plateau or patellar fractures.
- Bone Scan:**
  - Best For:**
    - Detecting stress fractures, tumors, or infection.
  - Indications:**
    - Recurrent unexplained pain with systemic symptoms.
- Key Considerations:**
  - Start with X-rays for acute trauma or chronic pain.
  - Use MRI for soft tissue evaluation when initial imaging is inconclusive.
  - Tailor imaging to the suspected diagnosis and patient presentation.

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### Diagnostic Work-up

- 1. When to Use Laboratory Tests:**
  - Indicated when knee pain is suspected to have systemic, infectious, or inflammatory causes.
  - Helps distinguish between mechanical, inflammatory, and infectious etiologies.
- 2. Common Laboratory Tests:**
  - A. Blood Tests:**
    - Erythrocyte Sedimentation Rate (ESR) & C-Reactive Protein (CRP):**
      - Purpose:** Detect systemic inflammation or infection.
      - Indications:** Suspected septic arthritis, rheumatoid arthritis, or other inflammatory conditions.
    - Complete Blood Count (CBC):**
      - Purpose:** Assess for infection or systemic disease.
      - Indications:** Fever, joint swelling, or suspected infection (e.g., septic arthritis).
    - Uric Acid:**
      - Purpose:** Identify hyperuricemia.
      - Indications:** Suspected gout (acute or chronic).
    - Antinuclear Antibody (ANA) & Rheumatoid Factor (RF):**
      - Purpose:** Screen for autoimmune conditions.
      - Indications:** Suspected lupus, rheumatoid arthritis, or other autoimmune diseases.
    - Anti-Cyclic Citrullinated Peptide (Anti-CCP):**
      - Purpose:** Confirm rheumatoid arthritis.
      - Indications:** Chronic, symmetrical knee pain with signs of inflammation.

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### Diagnostic Work-up

- 1. Joint Aspiration (Arthrocentesis):**
  - Purpose:**
    - Obtain synovial fluid for analysis to evaluate infection, inflammation, or crystal-related arthropathy.
  - Indications:**
    - Suspected septic arthritis.
    - Evaluation of gout or pseudogout.
    - Unexplained joint effusion.
  - Key Analysis:**
    - Cell Count:**
      - Elevated WBC > 50,000/mm<sup>3</sup> suggests septic arthritis.
    - Crystal Analysis:**
      - Monosodium urate (gout) or calcium pyrophosphate crystals (pseudogout).
    - Gram Stain and Culture:**
      - Detect bacterial infections.
- 2. Corticosteroid Injections:**
  - Purpose:**
    - Provide both diagnostic and therapeutic benefits.
  - Indications:**
    - Chronic inflammatory conditions (e.g., RA, OA flares).
    - Synovitis or joint effusion unresponsive to other treatments.
  - Key Features:**
    - Relief of pain helps confirm intra-articular inflammation.



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### Diagnostic Work-up

- 3. Lidocaine or Anesthetic Injections:**
  - Purpose:**
    - Confirm intra-articular pain source.
  - Indications:**
    - Differentiating joint pain from soft tissue or referred pain.
  - Procedure:**
    - Inject anesthetic and assess for immediate pain relief.
- 4. Image-Guided Procedures:**
  - Ultrasound-Guided Aspiration or Injection:**
    - Purpose:** Ensure accurate needle placement for diagnostic or therapeutic purposes.
    - Applications:** Bursitis, tenositis, and small joint effusions.
  - Fluoroscopy-Guided Injections:**
    - Purpose:** Used for deeper or more complex structures.
    - Applications:** Persistent knee pain unresponsive to simpler approaches.
- 5. Synovial Biopsy:**
  - Purpose:**
    - Obtain tissue for histological analysis in rare or complex cases.
  - Indications:**
    - Unexplained persistent inflammation.
    - Suspected atypical infections (e.g., tuberculosis).
  - Key Points:**
    - These procedures are often adjuncts to imaging and clinical assessment.
    - Provide valuable insights into the etiology of knee pain, especially in complex cases.

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### Key Diagnostic Criteria

- 1. Osteoarthritis (OA):**
  - Clinical Criteria:**
    - Age > 50 years.
    - Morning stiffness < 30 minutes.
    - Crepitus on active joint motion.
    - Bony tenderness or enlargement.
    - No palpable warmth of the joint.
  - Radiographic Findings:**
    - Joint space narrowing, osteophytes, subchondral sclerosis, and cysts.
  - Key Lab Tests:**
    - Typically normal; used to exclude inflammatory conditions.
- 2. Meniscal Tears:**
  - Clinical Signs:**
    - Joint line tenderness.
    - Swelling and stiffness, often delayed after injury.
    - Locking, catching, or clicking sensation.
  - Physical Exam:**
    - Positive **McMurray Test** or **Thessaly Test**.
  - Imaging:**
    - MRI: Gold standard for diagnosing meniscal tears.

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### Key Diagnostic Criteria

- 3. Anterior Cruciate Ligament (ACL) Injury:**
  - Mechanism:**
    - Twisting injury, often with a "popping" sensation.
  - Clinical Signs:**
    - Rapid swelling (hemarthrosis).
    - Instability or "giving way" sensation.
  - Physical Exam:**
    - Positive **Lachman Test** or **Anterior Drawer Test**.
  - Imaging:**
    - MRI: Confirms ACL tear and associated injuries.
- 4. Patellofemoral Pain Syndrome (PFPS):**
  - Clinical Signs:**
    - Anterior knee pain worsened by prolonged sitting, climbing stairs, or squatting.
    - No significant swelling.
  - Physical Exam:**
    - Positive **Clarke's Test** or pain during patellar compression.
    - Maltracking of the patella during motion.
  - Imaging:**
    - Optional; used to assess alignment or exclude other causes.

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## Key Diagnostic Criteria

- ▶ **5. Gout:**
  - **Clinical Signs:**
    - Acute onset of severe pain, swelling, redness, and warmth.
  - **Lab Tests:**
    - Elevated serum uric acid (not always diagnostic).
    - Synovial fluid analysis: Presence of monosodium urate crystals.
  - **Imaging:**
    - Chronic gout may show "punched-out" erosions on X-ray.
- ▶ **6. Rheumatoid Arthritis (RA):**
  - **Clinical Signs:**
    - Symmetrical joint pain and swelling.
    - Morning stiffness lasting >30 minutes.
  - **Lab Tests:**
    - Positive RF or Anti-CCP antibodies.
    - Elevated ESR or CRP.
  - **Imaging:**
    - Erosions, joint space narrowing, and periarticular osteopenia.

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## Treatment of Knee Pain

- ▶ **1. Lifestyle Modifications:**
  - **Weight Management:**
    - Reduces stress on the knee joint.
    - Each pound lost relieves 4 pounds of pressure on the knee.
  - **Activity Modification:**
    - Avoid high-impact activities (e.g., running on hard surfaces).
    - Focus on low-impact exercises (e.g., swimming, cycling).
- ▶ **2. Physical Therapy:**
  - **Strengthening Exercises:**
    - Focus on quadriceps, hamstrings, and gluteal muscles to improve joint stability.
  - **Stretching:**
    - Target tight structures (e.g., hamstrings, iliotibial band).
  - **Balance and Proprioception Training:**
    - Improves knee stability and reduces injury risk.
  - **Gait Training:**
    - Corrects walking patterns to reduce joint strain.

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## Treatment of Knee Pain

- ▶ **3. Bracing and Orthotics:**
  - **Knee Braces:**
    - Unloader braces for osteoarthritis to reduce medial or lateral compartment stress.
    - Knee sleeve
  - **Foot Orthotics:**
    - Correct alignment issues (e.g., flat feet) that contribute to knee pain.
- ▶ **4. Non-Pharmacologic Pain Relief:**
  - **Cryotherapy (Ice):**
    - Reduces swelling and acute pain.
    - Apply for 15-20 minutes every few hours.
  - **Heat Therapy:**
    - Relaxes tight muscles and alleviates chronic pain.
  - **Compression and Elevation:**
    - Control swelling and improve circulation.

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## Treatment of Knee Pain

- ▶ **5. Patient Education:**
  - **Joint Protection Strategies:**
    - Teach proper techniques for lifting, bending, and kneeling.
  - **Activity Pacing:**
    - Avoid overuse by balancing rest with activity.
  - **Postural Training:**
    - Maintain proper alignment during daily activities.
- ▶ **6. Alternative Therapies:**
  - **Acupuncture/Dry Needling:**
    - May provide relief for chronic knee pain in selected patients.
  - **Massage Therapy:**
    - Reduces muscle tension and promotes circulation.
  - **Yoga and Tai Chi:**
    - Improve flexibility, strength, and mental well-being.

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## Treatment of Knee Pain- Pharmacologic

- ▶ **1. Over-the-Counter Medications:**
  - **Acetaminophen:**
    - **Indication:** Mild to moderate pain.
    - **Mechanism:** Reduces pain without anti-inflammatory effects.
    - **Considerations:** Safe for most patients; avoid in liver dysfunction.
  - **Non-Steroidal Anti-Inflammatory Drugs (NSAIDs):**
    - Examples: Ibuprofen, Naproxen.
    - **Indication:** Pain with inflammation (e.g., osteoarthritis, tendinitis).
    - **Mechanism:** Reduces inflammation and pain by inhibiting COX enzymes.
    - **Considerations:** Use cautiously in patients with GI, renal, or cardiovascular conditions.
- ▶ **2. Prescription Medications:**
  - **Topical NSAIDs:**
    - Examples: Diclofenac gel.
    - **Indication:** Localized knee pain, particularly in osteoarthritis.
    - **Benefits:** Fewer systemic side effects compared to oral NSAIDs.
  - **Corticosteroids:**
    - Examples: Prednisone/dose pack (oral), Triamcinolone (intra-articular injection).
    - **Indication:** Severe inflammation or flares in conditions like rheumatoid arthritis.
    - **Mechanism:** Suppresses inflammation quickly.
    - **Considerations:** Limit long-term use due to systemic side effects.

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## Treatment of Knee Pain-Pharmacologic

- ▶ **3. Adjuvant Medications:**
  - **Muscle Relaxants:**
    - Example: Cyclobenzaprine.
    - **Indication:** Knee pain associated with muscle spasm.
  - **Neuropathic Pain Agents:**
    - Examples: Gabapentin, Pregabalin.
    - **Indication:** Pain from nerve-related conditions (e.g., radiculopathy).
- ▶ **4. Injectable Options:**
  - **Corticosteroid Injections:**
    - **Indication:** Acute inflammation or joint effusion.
    - **Benefits:** Rapid relief of inflammation.
    - **Frequency:** Limited to avoid joint damage.
    - **Viscosupplementation:**
      - Examples: Hyaluronic acid injections.
      - **Indication:** Osteoarthritis with inadequate response to other treatments.
      - **Mechanism:** Lubricates and cushions the joint.
  - **Platelet-Rich Plasma (PRP):**
    - Emerging option for degenerative conditions with variable results.



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### Zooming in: Knee Osteoarthritis



- **What is Knee Osteoarthritis?**
- **Definition:**
  - A degenerative joint disease characterized by cartilage loss, joint inflammation, and bony changes.
- **Epidemiology:**
  - Affects ~14 million adults in the U.S.
  - Most common in individuals over 50 years old.
- **Risk Factors:**
  - Age, obesity, joint injury, repetitive stress, genetics.
- **Pathophysiology:**
  - Cartilage degeneration → Joint space narrowing → Bone remodeling (osteophytes).

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### Zooming In: Knee Osteoarthritis

- **Clinical Features**
- **Symptoms:**
  - Joint pain (worsens with activity, relieved by rest).
  - Morning stiffness (<30 minutes).
  - Crepitus during movement.
  - Reduced range of motion and functional limitations.
- **Physical Exam:**
  - Bony tenderness/enlargement.
  - Joint effusion (mild to moderate).
  - Gait abnormalities.
- **Imaging:**
  - X-ray: Joint space narrowing, osteophytes, subchondral sclerosis.

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### Zooming In: Knee Osteoarthritis

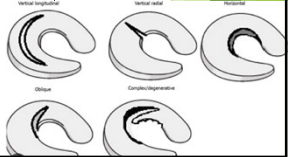
- **Management Overview**
- **Conservative Management:**
  - Weight loss, physical therapy (strengthening quadriceps, stretching), low-impact exercise.
  - NSAIDs or acetaminophen for pain relief.
  - Topical NSAIDs for localized symptoms.
- **Interventional Options:**
  - Corticosteroid injections for flares.
  - Viscosupplementation (hyaluronic acid) for persistent symptoms.
- **Surgical Options:**
  - Total knee arthroplasty for severe cases.
- **Prevention:**
  - Maintain healthy weight, avoid joint overuse, early injury management.



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### Zooming In: Meniscus Tears

- **Definition:**
  - A tear in the C-shaped cartilage (meniscus) that cushions and stabilizes the knee joint.
- **Types:**
  - Acute Tears: Result from trauma or twisting injuries.
  - Degenerative Tears: Associated with aging or chronic wear.
- **Epidemiology:**
  - Common in athletes (acute tears) and older adults (degenerative tears).
- **Risk Factors:**
  - Sports involving pivoting (e.g., basketball, soccer).
  - Age-related cartilage weakening.



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### Zooming In: Meniscus Tears

- **Clinical Features**
- **Symptoms:**
  - Pain localized to the joint line (medial or lateral).
  - Swelling, stiffness, and difficulty moving the knee.
  - Mechanical symptoms
    - Locking, catching, or clicking sensations.
- **Physical Exam:**
  - Joint line tenderness.
  - Positive **McMurray Test:** Pain or click during rotation.
  - Positive **Thessaly Test:** Pain or locking with twisting on a flexed knee.

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### Zooming In: Meniscus Tears

- **Diagnosis**
- **Imaging:**
  - X-Ray: Excludes fractures but does not visualize the meniscus.
  - MRI: Gold standard; identifies tear type, size, and location.
- **Common Tear Patterns:**
  - Radial, horizontal, bucket-handle, and complex tears.



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### Zooming In: Meniscus Tears

- Treatment Overview**
- Conservative:**
  - Rest, ice, compression, and elevation (RICE).
  - NSAIDs for pain and swelling.
  - Physical therapy to improve strength and mobility.
  - Best for STABLE tears
- Surgical:**
  - Meniscal Repair:** For tears in vascular zones (younger patients).
  - Partial Meniscectomy:** Removes irreparable parts of the meniscus.
  - Meniscal Transplantation:** For severe meniscus deficiency (rare).
- Prognosis:**
  - Depends on tear type, age, and treatment approach.

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### Zooming In: Patellofemoral Pain

- Definition:**
  - A condition characterized by anterior knee pain originating from the patellofemoral joint.
  - Also known as **Patellofemoral Pain Syndrome (PFPS)** or **Runner's Knee**.
- Epidemiology:**
  - Common in adolescents, young adults, and athletes.
  - More prevalent in women due to biomechanical differences.
- Risk Factors:**
  - Overuse (e.g., running, jumping).
  - Muscle imbalances or weakness (quadriceps, gluteals).
  - Malalignment or patellar tracking issues.

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### Zooming In: Patellofemoral Pain

- Clinical Features**
- Symptoms:**
  - Anterior knee pain, often described as "behind" or "around" the patella.
  - Worsens with activities like running, stair climbing, squatting, or prolonged sitting.
- Physical Exam:**
  - Palpation:** Tenderness along the patellar facets.
  - Patellar Compression Test (Clarke's Test):**
    - Pain with compression of the patella during quadriceps contraction.
  - Q-Angle Measurement:**
    - Increased Q-angle associated with patellar maltracking.

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### Zooming In: Patellofemoral Pain

- Diagnosis**
- Clinical Diagnosis:**
  - Based on history and physical exam findings.
  - No swelling or systemic signs.
- Imaging:**
  - X-rays:
    - Sunrise/Merchant view to assess patellar alignment and cartilage changes.
  - MRI:
    - Identifies chondromalacia or associated soft tissue abnormalities.

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### Zooming In: Patellofemoral Pain

Causes	Treatment
Decreased hip strength	Strengthening exercises for buttocks (gluteal) muscles
Decreased strength of thigh muscles that straighten your knee	Strengthening exercises for thigh (quadriceps) muscles
Tracking of the kneecap when you bend your knee	Taping or bracing of kneecap
Limited ankle motion or too much motion in the foot	Increase motion at the ankle and/or arches

- Management**
- Conservative Treatment:**
  - Physical Therapy:**
    - Quadriceps and gluteal strengthening.
    - Stretching tight structures (e.g., hamstrings, iliotibial band).
  - Activity Modification:**
    - Avoid pain-provoking activities; focus on low-impact exercises.
  - Bracing and Taping:**
    - Correct patellar tracking and reduce pain.
- Pharmacologic Options:**
  - NSAIDs for pain relief.
- Surgical Options:**
  - Rarely required; includes lateral release or patellar realignment in severe cases.

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# Thank You

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